Prof. Mira Sen (Banerjee) CME Article

A learning module in hair restoration surgery: A simple and economic method to learn all steps of strip method of hair follicles harvesting and implantation

Anil Kumar Garg, Seema Garg

Rejuvenate Hair Transplant Centre, Indore, India

Address for correspondence: Dr. Anil Kumar Garg, 2/1 RS Bhandari Marg, Janjirwala Chouraha, Indore - 452 003, India.
E-mail: anilgarg61@yahoo.com

ABSTRACT

Background: There is a global increase in demand for hair transplant as well as increasing demand for trained assistants and surgeons. It is a fact that permanent donor hair follicles are limited and any loss during learning is permanent and irreversible, so there is no place to learn and/or practice on a patient. **Objective:** To develop a learning module in hair restoration surgery to learn all steps of strip method of hair follicles harvesting and methods of implantation. **Materials and Methods:** In this learning module, the materials used are paper, pencil, plant leaf, foam and thread. The last step is on goat skin. Module has been divided into multiple steps. The first step is training of microsurgery position, the second step is training of movement at wrist using paper and pencil, the third step is strip harvesting and slivering on foam model, the fourth step is learning of follicle dissection on leaf model, the fifth step is thread follicle implantation on leaf bed. After practising on non-living model finally, all steps are practised on goatskin, starting from slivering, follicle dissection and implantation of goat follicles on leaf. **Conclusion:** This is very economical and user-friendly system to learn all steps of strip method of hair follicle harvesting and methods of implantation as well. The materials used are available around us and anyone can learn as well as train his or her technicians in very short time.

KEY WORDS

Goat model; implantation; leaf model; learning hair transplant; slivering

INTRODUCTION

The demand for hair transplantation is constantly increasing, and new hair transplant centres are opening all over the world. However, there are very few training centres and fellowship programmes globally to fulfil the demand for trained assistants and technicians. In today's time certainly, demand for follicular unit extraction is increasing, but still strip surgery has

Access this article online

Quick Response Code:

its strong indication, especially when higher number of grafts are needed. A hair transplant surgeon shall learn both techniques and practice them and use judiciously as per patient's conditions and demand.

The author has developed a very effective, user-friendly and economical model to learn and practice all steps of hair transplantation. The other available methods are on synthetic material, and they are expensive or usual practice is teaching them directly on human follicles in small sessions, which certainly not at all ethical. Materials required for this training model[1] are readily available, very economical and give feeling of live tissue. Materials such as foam,[2] money plant leaf (thick leaf), simple stitching black thread, needles and wooden spatula are needed for this model. The second stage of the model utilises goatskin and a helmet.

AIMS AND OBJECTIVE

To design a module to learn and practice all steps of strip method of hair follicle harvesting and implantation on non-human material.

MATERIALS AND METHODS

The module has been divided in multiple stages to learn multiple steps (procedures) required for strip method of follicle harvesting and implantation. The first objective of learning is 'learning of micro surgery[3] position', the second objective is 'wrist movement by paper and pencil module' and the third objective is 'follicle dissection on leaf model and slivering on foam model'. The last objective is to learn and practice 'implantation on leaf and thread model'. Ultimate objective is to practice all steps on goatskin model. All steps have been described separately with details of their methods and material.

Step-wise planning of learning

Microsurgery posture → wrist movement (paper and pencil) → follicle dissection on money plant leaf → slivering on foam → implantation on leaf scalp → practice all steps on goat skin.

1. Microsurgery posture

The entire process of hair transplantation is microsurgery. All basic principles of microsurgery should be followed, including magnification,[4] proper position

Figure 1: Microsurgery posture

of surgeon, instrument quality and range of hand movements [Figure 1].

Here, the objective is to learn ideal microsurgery posture. The position of the surgeon or assistant should be such that all body joints are at a functional position. Practice every day till you develop to sit normally in this posture.

2. Training of movements at wrist-Paper model

Proper microsurgery hand position allows the surgeon to isolate movements at the wrist. Follicle dissection requires wrist movements in a forward and backward direction while slivering and implantation needs downward and upward wrist movements. No side-to-side movements are required during the entire process of hair transplantation. These motions can be learned and practised by making straight lines on paper using pencil or pen.

- Objective –To learn movement at wrist joint only
- Material –Plane paper and a pencil, suitable magnification
- Method – Make small rectangle/square boxes on paper. Require assistant to make straight parallel equidistant lines in box while maintaining proper microsurgery position. Begin without magnification and then add magnification. Assistant should complete 15 sheets under magnification.[5] Practice till you do not attempt movement at elbow and side to side over wrist joint [Figure 2].

3. Strip harvesting-Foam model

This model is used to learn how to hold the scalpel, how to identify which part of the blade is needed in strip harvesting and how to raise strip while dissecting in one plane of tissue.
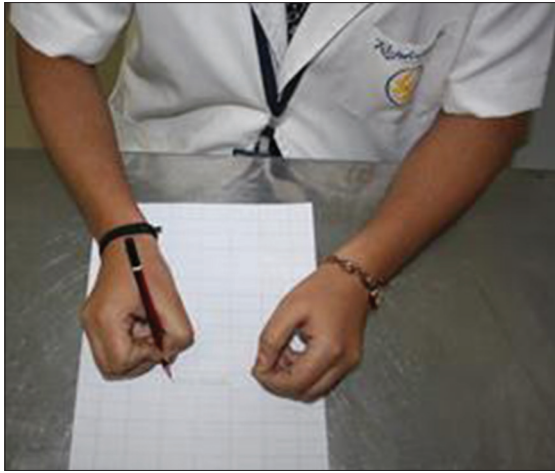
Figure 2: Making straight equidistance parallel lines on a paper

- Objective – To learn strip harvesting
- Material – Once inch thick high-density foam piece 8 cm × 10 cm in size, wooden platform, marking pen, scalpel and toothed forceps
- Method – Fix foam-to-wooden platform or other surface. Mark strip area with skin marking pen. Hold scalpel in dominant hand in pen-holding position. Keeping sharp edge of scalpel almost parallel to surface of foam a partial thickness cut is made over marking. The depth of incision should be same all around; this is only possible when you apply equal pressure over scalpel. Direction of incision is slightly oblique as hair direction in scalp is oblique and we need to follow the direction of the hair follicle. Next, using toothed forceps hold one end of strip and pull it up and cut underneath with scalpel taking care to cut in same plane and thus harvesting uniform thickness of foam strip. This must be practised multiple times to achieve a foam strip of uniform thickness [Figure 3a].

4. Slivering

Slivering training is divided into two phases. First, we learn to move the scalpel in an up and down direction while creating thin slices of foam. Next, we practice slivering on a foam strip woven with thread. Black thread with a knot symbolises the graft, and during this phase, they should not be cut.

- Objective – To learn slivering on foam
- Material – One-inch thick foam, black stitching thread, sewing needles, skin marker
- Method
    a. Cut small pieces of foam 1 cm thick, 2 cm wide and 7–10 cm long. Using skin marker, make multiple straight parallel lines at 2–3 mm intervals on surface of foam. The foam strip represents a

sliver and the marked lines represent rows of hair follicles. Fix this foam sliver on wooden spatula using needles. Start slivering with a fine tooth forceps in non-dominant hand and scalpel in dominant hand. Toothed forceps should grab upper edge of foam sliver while scalpel cuts between two lines from top surface of foam to bottom. While scalpel is cutting pull foam sliver outside and slightly upward so there is increased gap between two rows. Continue practice till you get thin, equal uniform slices of foam are produced [Figure 3a-b]

    b. Black stitching thread is used to represent the hair follicle and a single knot of thread represents the hair bulb. Using a needle, multiple threads are sewn in rows on a foam strip, with a knot on the underside, leaving small free ends of threads on the other as shown in figure [Figure 3c-e].

Slivering is started as explained in above, taking care not to cut thread or its knot.

5. Follicle dissection-Leaf model

- Objective – To learn follicle dissection on leaf
- Material – Thick plant leaf such as leaf of money plant (*Epipremnum aureum*). These are thick and have texture similar to skin. Marking pen, scalpel and forceps, magnification
- Method – Prepare 5 cm × 2 cm pieces of thick leaf. Create 10 mm long parallel lines in centre of leaf strip. These lines represent hair follicles. Begin follicle dissection under microscope or other magnification.[6] Assistant cuts between lines and makes small pieces of leaf having a line at the centre of each piece. Each line represents a hair and hair bulb and leaf part is peri-follicle tissue. During this step, the assistant also practices coordination of scalpel and forceps. Any indentation of forceps over leaf surface warns assistant that the grip of the forceps should be softer so as to avoid crushing follicle. The assistant should cut at least 100 such plant follicles till they get uniform leaf follicles [Figure 4a].

6. Implantation

- Objective – To learn and practice implantation of follicles by both stick place and slit method implantation
- Material – Money plant leaf (leaf of any plant which is thick and soft), wooden spatula, slit making knife, needles, black thread and diluted adhesive
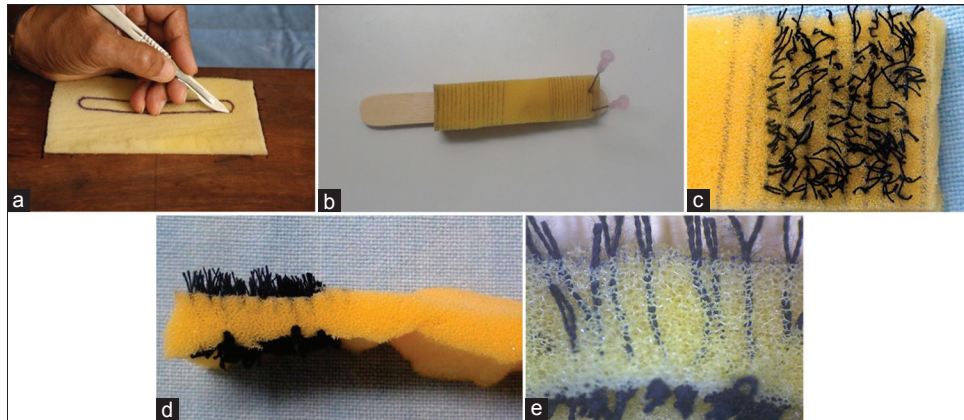
Figure 3: (a) Foam strip harvesting, (b) markings for rows of hair on foam, (c and d) thread woven foam strip, (e) sliver of foam and thread
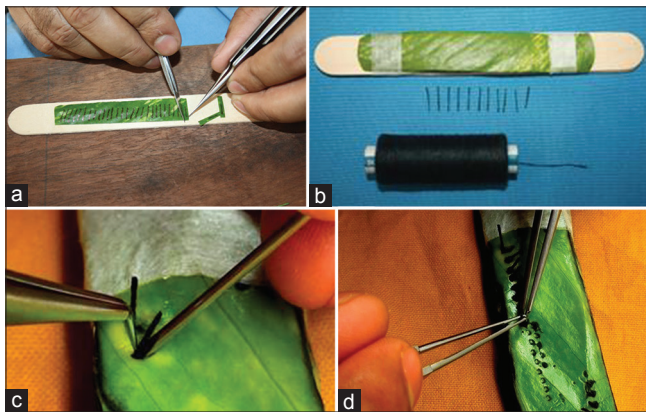

Figure 4: (a) Follicle dissection (b) Preparing threads follicles and leaf scalp. Multiple leaf strips are put over each other to make it as thick as scalp. (c) Stick and place technique. Implantation of thread follicles on 'leaf scalp' using needle and forceps. (d) Premade slit and Implantation. Implantation of thread follicles in pre-made slits using two forceps. Slits made using needle

solution (e.g., Fevicol solution, a synthetic resin adhesive)

- Method – Create a scalp model by stacking multiple pieces of leaf of equal length and width until an 8–10 mm thick layer of leaf bed is formed and secure them to a wooden spatula. Now, create hair follicles using black thread. Immerse black thread in a diluted adhesive solution, then allow the thread to dry, making it stiff. Next cut thread into multiple 8 mm long pieces. Thread follicles are now ready to implant. To teach implantation into pre-made slits, first make multiple slits into bed of leaf scalp model using either needle or slit knife blade, then use preferred technique with one or two forceps and one needle. Dilate the slit using forceps and implant thread into hole.

To teach the stick and place technique, insert needle in leaf model 3–4 mm deep and implant thread by sliding it along bevel portion of needle [Figure 4b-d].

Goat model-Practice of all steps
Human hair follicles are precious as they are limited and not reproducible. Damage to follicles causes permanent loss of safe donor area,[7] which is bad for our patients, so practice with the goal of achieving zero transection of human follicles. Goatskin is readily available and inexpensive and is a very versatile model to practice on before starting on human skin. Goatskin gives you the feel of human skin, and although goat follicles are shorter and have higher density then human follicles, this can be an advantage when learning.

- Objective – Practice of all steps of follicle harvesting on goatskin
- Material – Black goat fresh skin measuring 10 cm × 2 cm
- Method – Clean the skin with tap water, shave it and then again clean it with tap water. This goatskin piece is ready for slivering practice [Figures 5a].

Slivering of goatskin strip
After attaching goatskin to wooden spatula, slivering is performed under magnification as we learned on the foam model. This goatskin feels like human skin but with greater density with shorter length of follicles. Excess fat is trimmed away. Practice till we achieve single follicle thick sliver with intact hair bulb.

Follicle dissection of goat sliver
Goat slivers are then dissected under the microscope or any magnification of your choice. All precautions are taken and practised as if human follicles were being dissected,[8] including de-epithelisation, trimming and irrigation. A trainee shall at least dissect 20 slivers and check for transection of follicles. The follicle transection shall be <1%. Goat follicles are now ready for implantation into leaf scalp model.

Figure 5: (a) Goatskin piece shaved and mounted over wooden spatula for slivering. (b) Leaf mounted over helmet. (c) Goat follicles implanted

Implantation of goat follicles

- Material – Goat follicles, leaf, adhesive tape, helmet
- Method –Mount 5–6 layers of leaf on the front side of a helmet or other similar model of a human head. This provides a curve and surface similar to human scalp except that it is little larger. Practice implanting goat follicles either by slit method or stick and place method. Whatever method is adopted one shall continue to practice same. One shall check for dehydration and damage to follicles. A trainee should at least implant 2000 follicles before implanting on human [Figure 5b and c].

DISCUSSION

The demand for hair transplantation is constantly increasing reason being it seems more financially lucrative as well as increase in baldness and desire to treat it. New hair transplant centres are opening day by day. However, there are very few training centres and fellowship programmes globally to fulfil the demand for trained assistants and technicians.[9] Usually, hair transplant is taken as an easy money earning procedure, but it is a microsurgery and requires training, magnification, understanding hair biology and safe donor area concept.

There are lots of other reconstructive surgeries being done and learn during plastic surgery training. This makes a valid reason for lack of time to teach and learn hair transplant surgery. Hair transplant learning directly on patient may lead to loss of limited permanent donor hair follicles. Hence, we need a learning module which should be economical, user-friendly and efficient.

Goatskin or other animal skin models are available but are in true sense not user-friendly. Getting animal skin every day does not seem be a practical solution especially for hair transplant which is commonly being done in a smaller private set up. To practice implantation, rubber sheets and nylon thread as hair follicles have been used. Proper rubber sheets are not commonly available. The synthetic sheets and hair grafts are expensive with limited availability.

Use of other vegetables such as potato and oranges has also been used as a platform for implantation. However, till date, no module is available which provides proper, regular, consistent, economical and efficient training of each and every step of strip method of hair follicle harvesting.

This module provides a comprehensive training starting form microsurgery position, movements at wrist joint only and learning to work with magnification. To learn a particular movement a separate module has been designed. The materials used here are available in-house without cost and any extra effort. Materials such as foam, money plant leaf (thick leaf), simple stitching black thread, needles and wooden spatula are simple things required. The second stage of the model utilises goatskin and a helmet. Two and three sessions of goatskin module is good enough for final learning. Hence, goatskin is not needed for entire learning process.

CONCLUSION

The steps outlined in this training module are versatile, user-friendly and economical for learning all steps of the hair transplant. The author has used this to train all his team members. Two hours per day for 3–4 weeks can train a technician in basic knowledge of the hair transplant procedure, follicle care and the importance of graft hydration, ischaemia and temperature control. The delicacy of the hair follicle should be repeatedly explained, and we help them realise how important their job is. Hair transplantation requires teamwork and every step should be performed with the optimum results for the patient in mind.

Declaration of patient consent
The authors certify that they have obtained all appropriate patient consent forms. In the form the patient(s) has/have given his/her/their consent for his/her/their images and other clinical information to be reported in the

journal. The patients understand that their names and initials will not be published and due efforts will be made to conceal their identity, but anonymity cannot be guaranteed.

Financial support and sponsorship
Nil.

Conflicts of interest
There are no conflicts of interest.

REFERENCES

1. Garg A. Training module in hair restoration surgery. In: Mysore V editor. Hair Transplantation. 1st ed. New Delhi: Jaypee Brothers; 2016. p. 60, 394-400.
2. Lam SM. Staffing and training 360. Hair Transplant 360. Vol. 2. Jaypee brothers: New Delhi; 2011. p. 21.
3. Kirane V. Ergonomics in hair transplantation surgery. In: Mysore V editor. Hair Transplantation. 1st ed. New Delhi: Jaypee Brothers; 2016. p. 427-30.
4. Bernstein RM, Rassman WR. Dissecting microscope versus magnifying loupes with transillumination in the preparation of follicular unit grafts. A bilateral controlled study. Dermatol Surg 1998;24:875-80.
5. Limmer BL, Limmer B. Donor Strip Slivering and Microscopic Dissection, Procedures in Cosmetic Dermatology Hair Transplantation; 2006. p. 87-9.
6. Limmer BL. Elliptical donor stereoscopically assisted micrografting as an approach to further refinement in hair transplantation. J Dermatol Surg Oncol 1994;20:789-93.
7. Devroye J. An overview of donor area-basic principles. In: Unger W, Shapiro R, editors. Hair Transplantation. 5th ed. New York: Informa Health Care; 2011. p. 247.
8. Seager D. Classic microscope dissection of follicular units. In: Unger W, Shapiro R, editors. Hair Transplantation. Revised and Expanded. 4th ed. New York: Marcel Decker; 2004. p. 361.
9. Lardner T, Harris J. Surgical assistant. In: Unger W, Shapiro R, editors. Hair Transplantation. Revised and Expanded. 5th ed. New York: Informa Health Care; 2011. p. 510-1.